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“Beauty” premium for social scientists but “unattractiveness” premium for natural scientists in the public speaking market

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In the face of scientists’ increasing engagement in public discourse, we examine whether facial attractiveness affects their market value (i.e., audience willingness to pay). For a sample of scientists who participate in public speaking, we find that facial attractiveness is uncorrelated with *internal* academic achievements (as measured by publications and citations) and is only weakly but positively linked to attention outside of academia. Notably, we find that the effect of facial attractiveness on external influence is only robust to measures where speakers’ physical appearance is likely to be most apparent to the public, such as invitations to give TED talks or Google web page counts while the effect on the number of book publications or book awards is not significant. Our results also suggest that these relationships do not differ across scientists’ fields of research. However, we find that in terms of speaking fees, social scientists benefit substantially from being more attractive, whereas unattractiveness is a comparative advantage for natural scientists. A similar divergence in the direction of the relationship between speaking fee and facial attractiveness is also evident for nonacademic speakers from different fields: whereas those from a natural science (job) background gain from unattractiveness, those with a social science history benefit from a beauty premium. This market premium for unattractiveness conforms not only to the common stereotype of the natural scientist but also to a belief that the more unattractive of these researchers engage in higher quality work. Overall, the findings indicate that facial appearance is important in the public perception of academics and, to some extent, their dissemination of knowledge.

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Introduction

Because the communication of science issues, science policies, discoveries, or innovations to the broader community is part of academia's social responsibility, the forging of stronger ties between science and society has emerged as an increasing trend in recent decades (see, e.g., Chan et al., 2016; Jensen et al., 2008). For example, Martin Rees' foreword to a Royal Society report on science communication¹ emphasizes the need for scientists to engage more fully with the public, while the European Commission has taken initiatives to change public attitudes toward science and scientists (Tintori, 2017). Ineffective communication of science is costly, as science requires public support (Fischhoff and Scheufele, 2013). In 2013, PNAS organized a special issue on the science of science communication, which was based on a colloquium organized by the Academy (for an introduction see (Fischhoff and Scheufele, 2013)) to better understand successful science communication (Fischhoff, 2013). Scheufele (2013), for example, stresses that "the lack of scientific literacy among nonexpert publics and their limited frameworks for processing new scientific information are of particular concern, given the scientific and policy uncertainties surrounding many areas of emerging science" (p. 14041). Any greater engagement of scientists in the societal discourse, therefore, raises the question of which factors contribute to their prominence or success in terms of recognition for their scientific contribution to society. More specifically, it raises the question of how such recognition is achieved among the general public and other decision-makers, given they are not used to evaluating real academic performance, or are not easily able to access scientific insights (von Winterfeldt, 2013). That is, if success is defined as a collective phenomenon based on the external judgments of others (Fortunato et al., 2018) and communication about science does not happen in a vacuum (Fischhoff and Scheufele, 2013), it may be shaped not only by scientific competence or academic achievement but also by individual characteristics such as perceived facial attractiveness.

Indeed, the research does in fact document a "beautiful-is-good halo effect" (Liu et al., 2018) that may lead to attractive individuals being judged and treated more positively (Adams and Crane, 1980; Berscheid et al., 1971; Dion, 1973; Langlois et al., 1991; Snyder et al., 1985). These individuals may even be rated as more sociable, dominant, sexually warm, mentally healthy, and socially skilled than less attractive persons (Feingold, 1992). Such a beauty premium is also observable in the labor market (Hamermesh, 2011), where it leads to better income or job market opportunities (Case et al., 2009; Chang and Lauderdale, 2005; Dinsa et al., 2012; Frieze et al., 1991; Hamermesh and Biddle, 1994; Harper, 2000; Mobius and Rosenblat, 2006; Persico et al., 2004; Roszell et al., 1989; Steven et al., 1995; Vandegrift and Yoked, 2004). Yet, although experimental evidence indicates that more attractive individuals are more confident in problem-solving, it does not indicate they are more productive (Mobius and Rosenblat, 2006). Nonetheless, in academia, better-looking teachers tend to receive higher teacher ratings than their colleagues (Hamermesh and Parker, 2005; Myers, 1995), while more attractive doctoral graduates enjoy better first job placements and are awarded tenure faster (Liu et al., 2018). The public also appears more interested in learning about the work of more attractive scientists, although their attractiveness is negatively correlated with public judgments about whether the work is of high quality (Gheorghiu et al., 2017).

Like any group, however, scientists are also subject to stereotypes (Cheryan et al., 2013), and are usually portrayed as male, old, bald, small and stout (or tall and reedy), clad in a lab coat, and marked by a pair of thick glasses under a wild head of hair (Mead and Metraux, 1957; Schinske et al., 2015; Tanner, 2009).

They may also be negatively viewed as uninteresting, dull, socially clumsy, secretive, demanding, obsessive, competitive, dangerous, unsociable workaholics isolated from the world (Schneider, 2010; Tintori, 2017). Stereotypes are particularly dominant in STEM fields (Schneider, 2010), where they also affect class performance (for an overview, see Schinske et al., 2015) and possibly even student choices of study subject. For example, students are more likely to pursue majors and careers in science if they agree with the positive stereotypes (Schinske et al., 2015) of dedicated, intelligent, altruistic, and driven professionals (Schneider, 2010). The public view of science and scientists is also negatively influenced, however, by their narrow representation in the media (Schinske et al., 2016), which often depict chemists as the standard scientist (Finson, 2002). Thus, natural scientists, compared to social science scholars, may be more likely affected by a stereotypical nonattractiveness bias and benefit from it as a quality signal, that is, public perception about academic quality may be higher for less attractive natural scientists (compared to those who are more attractive), while such effects on their social science counterparts may be less salient. A comparison between natural and social scientists is particularly interesting, as limited insights are available on social scientists.

Because scientists who actively engage with the public can shape the general societal discourse by leveraging their public profile and skills, we assume that stereotypes could also affect their ability to generate social interest and their external influence (via perception of academic quality), which we capture by the number of Google search results of the speaker's name, the number of TED talks given, and recognition of their book publications (Chan et al., 2016). Stereotypical bias could also influence scientists' ability to capitalize on their external prominence and societal reputation, which we measure by speaking fees as a proxy for marketplace value (Thelwall, 2019). These fees, which signify an audience's willingness to pay in the speakers' market, quantify the speaker's importance to and interest for the public, serving as an appraisal of the scientist's societal worth and reflecting the relevance of their knowledge for practical issues or specific interested groups (Chan et al., 2014a, 2014b). In particular, given the previously discussed evidence of a beauty premium, we explore whether the speaker's market value is affected by facial attractiveness. In doing so, we also differentiate between social and natural scientists to test whether unattractive natural scientists, relative to unattractive social scientists, are better able to achieve higher speaking fees than their better-looking peers. The scholar scientists studied are pro-actively interested in public engagement and perceived by speaking platforms and agencies as sufficiently interesting to be invited as speakers. Our exploratory study thus recognizes that their attractiveness levels may differ from those of other scholars in the same discipline, which could lower the likelihood of our observing intrafield differences. We also extend the analytical focus by including speakers not in academia but who have a social science or natural science background.

Methods

Public speaker data and speaking fees. The data on 734 public speakers, collected between December 2013 and January 2014 (Chan et al., 2014a, 2014b), were taken from speaker profiles on the websites of eight North-America based speaker agencies (BigSpeak Speakers Bureau, Keppler Speakers, Leading Authorities Speakers Bureau, Premiere Motivational Speakers Bureau, Speakerpedia, Speakers Platform, Sweeney Agency, and Washington Speakers Bureau). The final sample comprises 217 full-time academics (over half the career spent at an academic

institution), 151 part-time academics (over half the career spent at a private or government institution while affiliated with academia for some of this period), and 366 nonacademics (no work or affiliation with any academic institution). The lower end of the fee range represents the minimum speaking fee (unless no range is specified), with the highest of the lower-end range values used as the fee for speakers listed on more than one agency website (Chan et al., 2014a, 2014b).

Facial attractiveness data. Facial attractiveness is based on photographs (frontal portraits) of the speakers obtained from public domains such as personal, professional, and institutional websites, or via a Google image search. Our searches successfully located a frontal portrait for 726 of the 734 speakers in the sample. We use Anaface.com, the web-based software for photo analysis that evaluates factors such as horizontal symmetry, nose to ear length ratio, nose width to face width ratio, mouth width to nose width ratio, face width to face height ratio, and eye width to innerocular distance ratio (Halford and Hsu, 2014; Hoeghele et al., 2016; Sung et al., 2016; Babin et al., 2019; Baugh et al., 2019), to proxy for facial attractiveness. The software assigns each photo a beauty score from 1 to 10 based on facial geometry differentiated by gender. Because facial averageness or symmetry is a prime candidate not only for sexual selection and reproduction but also for overall phenotypic quality and developmental health (Alcock and Thornhill, 2014; Grammer and Thornhill, 1994; Thornhill and Gangestad, 1993; Trivers, 1985), facial averageness and symmetry are highly correlated with human beauty ratings (Komori et al., 2009; Rhodes et al., 2001). Using a facial structure-based proxy is equally important and avoids any familiarity bias, which could otherwise be an issue given our subjects' considerable public exposure (e.g., through TED talks or best-selling books). However, such a project cannot be classified as an objective measure, because individual (Hönekopp, 2006) and cross-cultural differences exist with respect to the features of an attractive face (Little et al., 2011), a point that Darwin (1871) emphasized over 200 years ago. Measurements to assess attractiveness can vary culturally (Yu and Shepard, 1990) and are subject to westernization (Yu and Shepard, 1998), as many studies have been conducted in North America, Britain, or Australia (Little et al., 2011). However, some meta-analysis evidence indicates the existence not only of within-culture agreements, but also of strong cross-ethnic and cross-cultural agreements among raters about who is and who is not attractive (reliability between $r = 0.88$ and $r = 0.94$). This may indicate some universal standards by which attractiveness is judged (Langlois et al., 2000; Rhodes 2006). Such cross-cultural or cross-ethnic consistency in ratings are particularly evident when evaluating female faces (Johnston and Franklin, 1993; Little et al., 2011) or when evaluating unattractive faces (Sorokowski et al., 2013). Apicella et al. (2007) also find a preference for averageness within an isolated hunter-gatherer society, namely the Hadza of Northern Tanzania. Agreement is also higher among relatives than strangers (Bronstad and Russell, 2007). For example, Cunningham et al. (1995) find that Asian, Hispanic, and White judges gave higher ratings to faces with neonate large eyes, greater distance between eyes, and small noses.

Because this facial geometry is predicated on 17 facial landmarks placed manually on the speakers' images (see Fig. S1 in the SI Appendix), between June 5 and June 20, three research assistants made independent evaluations of each sample photo to minimize potential measurement error from manual placement. The average of the three scores was then used in the subsequent analyses (see Table S1). In the Supplementary Information, we offer detailed documentation regarding the complete procedure

for measuring facial attractiveness of our sample speakers and the process of validating the attractiveness scores obtained from Anaface.com with facial geometry-based beauty measures suggested by prior literature. Notably, a recent study by Babin et al. (2019) found that Anaface scores are weakly (but significantly) positively correlated with human attractiveness ratings, thus providing support for the internal validity of using Anaface score as a proxy measure for facial attractiveness. Nevertheless, due to research funding and capacity limitations, we are unable to conduct the ideal validation exercise with an independent sample of models and human raters.

Performance and influence data. Internally within academia, performance can be estimated by the total number of publications and citations, citations per paper, and *h*-index from Google Scholar and Scopus for speakers with an academic background. The number of web pages mentioning the speaker's full name, which were indexed by the Google search results, served to quantify external influence and prominence. Search queries (excluding pages from an.edu domain) were automated on April 14, 2014 using the Google search application programming interface (API) (Chan et al., 2014a, 2014b). An exclusion rule was applied manually to avoid spurious matches, and a search count was deemed invalid if five or more pages were not attributed to the speaker ($N = 154$) (Chan et al., 2014a, 2014b). External impacts were additionally measured by TED talk experience (number of times invited to present at TED conferences before 2013), number of books published (titles listed with the US Library of Congress), and recognition (number of New York Times best-selling books, number of weeks on the NYT list, and any of 21 major nonfiction book awards) (Chan et al., 2014a, 2014b).

Speaker biographical information. Based on the automated word searches, we categorize speakers by field of expertise into three groups: natural science (e.g., physics, biology and medicine, $N = 187$), social science [business] (e.g., economics, finance, management, and marketing, $N = 358$), and social science [other] (e.g., sociology, psychology, and political science, $N = 189$) (Chan et al., 2014a). We differentiate those two social science groups based on the sample size (see Supplementary Table S2), including under business-related speakers all those fields that are usually part of a Business School. As is evident from the descriptive statistics these scholars are more active in the speaking market. Supplementary Table S2 also details the field of studies for the sample speakers. The information on gender, ethnicity, and professional age (years since highest degree) is taken from speaker biographies, CVs, LinkedIn entries, and Wikipedia images. We also use the within-field average rankings from the 2004–2018 QS World University rankings in Natural Sciences and Social Sciences and Management (UniversityRankings.ch) to quantify the quality of education at the university that awarded each speaker's highest degree. Because the rankings only cover the top 500 universities, we assign a rank of 500 to any universities that do not appear on the rankings.

Data analysis. All analyses use ordinary least-squares (OLS) regressions with heteroscedasticity consistent (robust) standard errors². Because academic achievements and external influence are the main determinants of the scholars' speaking fees (Chan et al., 2014a, 2014b), we first examine the relation between these two variables as a check for conflation in the main association between facial beauty and speaking fees. In analyzing facial beauty's effect on scholarly achievements and external influence, we control for the scholars' biographical characteristics: gender (male = 0, female = 1), ethnicity (dummy variables for African

and Asian, with Caucasian as the reference group), professional age (years since highest degree), professional age squared³, QS ranking of the university of highest degree, whether a Nobel Prize winner (laureate = 1, others = 0), whether US based (outside US = 0, US = 1), academic engagement (less than half the entire career spent in academia = 0; more than half the entire career spent in academia = 1), and academic discipline (natural sciences, social sciences, business). Based on (Chan et al., 2014a, 2014b), we proxy the scholars' academic achievement by number of publications (productivity) and citations (academic impact) and their external influence by number of webpages (in non-educational network domains) with the scholar's full name indexed on Google, all assumed to be the main predictors of speaking fees charged. To assess whether the discipline is mediating the relation between facial beauty and speaking market value, we use interaction terms to estimate the difference in slope coefficients between facial beauty and discipline. As the distributions are skewed, we also log-transform the number of publications, number of citations, Google search results, and minimum speaking fees. Descriptive statistics are reported in Supplementary Table S3. When reporting the results of our analyses, we include four statistical significance levels, 0.001, 0.01, 0.05, and 0.1.

Results

Facial attractiveness and academic achievement. Our results show that, once we control for important factors such as the quality of the educational institution (Chan and Torgler, 2015), facial attractiveness has no statistically significant relation to scientific output or citation-based productivity (Table 1) (Publications_{GoogleScholar}: $b = 0.102$, $P = 0.096$; Publications_{Scopus}: $b = -0.032$, $P = 0.589$; Citations_{GoogleScholar}: $b = 0.084$, $P = 0.361$; Citations_{Scopus}: $b = 0.045$, $P = 0.675$; Citations per paper_{GoogleScholar}: $b = -2.163$, $P = 0.362$; Citations per paper_{Scopus}: $b = 0.709$, $P = 0.723$; h -index_{GoogleScholar}: $b = 0.286$, $P = 0.813$). Nor does the inclusion of interaction effects designed to pinpoint differences between social and natural sciences identify beauty premium differences between these fields (Table 2 and Fig. S3) (Publications_{GoogleScholar}: $b = 0.087$, $P = 0.425$; Publications_{Scopus}: $b = -0.003$, $P = 0.981$; Citations_{GoogleScholar}: $b = -0.008$, $P = 0.958$; Citations_{Scopus}: $b = 0.061$, $P = 0.722$; Citations per paper_{GoogleScholar}: $b = -5.416$, $P = 0.148$; Citations per paper_{Scopus}: $b = -1.355$, $P = 0.569$; h -index_{GoogleScholar}: $b = -0.782$, $P = 0.777$). These results remain robust to dividing scholars into full-time and part-time academics (i.e., those who spend more than half their careers in the private or government sector while still being affiliated with academia for some of this period) or alternative citation metrics (see Supplementary Material Table S8, S9, and Fig. S3).

Facial attractiveness and various external influences. We then examine a large number of factors that measure external influence while controlling or not controlling for academic productivity (Table 3). We can see that facial attractiveness is beneficial in certain contexts but not in others. The most notable effects are those for factors closer to the broader social and public sphere (e.g., numbers of TED talk invitations ($b = 0.0567$, $P = 0.06$; controlling for academic productivity: $b = 0.056$, $P = 0.071$), weeks on the New York Times Best Seller list ($b = 0.996$, $P = 0.081$; controlling for academic productivity: $b = 1.026$, $P = 0.073$), and mentions on noneducational Google web pages ($b = 0.207$, $P = 0.033$; controlling for academic productivity: $b = 0.156$, $P = 0.047$)).⁴ For example, a one score increase in facial attractiveness lengthens the time on the New York Times Best Seller list by one week and increases the Google web page counts by around 20 percent. This relationship is unlikely to be moderated by the scholar's field of research, as we did not find that the relationship between facial attractiveness and external influence statistically differs between natural and social scientists (Fig. 1). Nevertheless, the main effects for facial attractiveness are less precisely estimated.

Facial attractiveness and speaking fees. To explore speaking fees in more detail, we next differentiate between social and natural sciences, finding that social scientists, particularly in the non-business domain, benefit from a "beauty premium" (social sciences (business): $b = 0.204$, $P = 0.034$; social sciences (others): $b = 0.364$, $P < 0.001$), while natural scientists are indeed subject to an "unattractiveness premium" (Fig. 2), with a one unit reduction in facial attractiveness increasing their minimum speaking fees by 19 percent (Table 4, specification 1, $P = 0.011$). Such beauty or unattractiveness premiums are observable even for nonacademic public speakers (specification 3; natural sciences: $b = -0.147$, $P = 0.059$; social sciences (business): $b = 0.189$, $P = 0.053$; social sciences (others): $b = 0.262$, $P = 0.056$) or for both samples combined (specification 4; natural sciences: $b = -0.176$, $P = 0.001$; social sciences (business): $b = 0.201$, $P = 0.004$; social sciences (others): $b = 0.327$, $P < 0.001$).

Discussion

Our results on the benefit of facial unattractiveness for natural scientists are consistent with the finding of a previous PNAS study indicating that less attractive researchers are judged to be better scientists (Gheorghiu et al., 2017). In this study, we complement previous evidence on individual judgments by focusing on speaking fees as a proxy for the willingness to pay for a scientist's public engagement in the marketplace (Chan et al., 2014a, 2014b). Given that our sample consists of individuals who

Table 1 Facial attractiveness and academic performance.					
		Facial attractiveness		Observations	R ²
Productivity		Coeff.	t-Stat.		
(1)	ln(Publications) (Google Scholar)	0.102 [†]	(1.67)	354	0.323
(2)	ln(Publications) (Scopus)	-0.0316	(-0.54)	328	0.443
(3)	ln(Citations) (Google Scholar)	0.0835	(0.914)	351	0.388
(4)	ln(Citations) (Scopus)	0.0451	(0.42)	297	0.347
(5)	Citations per paper (Google Scholar)	-2.16	(-0.913)	360	0.162
(6)	Citations per paper (Scopus)	0.709	(0.355)	297	0.090
(7)	h-index (Google Scholar)	0.286	(0.236)	351	0.267

The sample includes 368 academic speakers. Each row reports a separate ordinary least squares regression with controls for discipline (natural sciences and social sciences), gender, ethnicity (African and Asian vs. Caucasian), academic age (and its squared term), ranking of university bestowing highest degree, and dummies for Nobel Prize winner, North American based, and part-time academic. Full regression output is given in Supplementary Table S4. t-statistics are in parentheses.

[†] $p < 0.10$.

Table 2 Facial attractiveness and academic performance: between-field comparison.

Dependent variable	(1) <i>ln</i> (Publications) (Google Scholar)	(2) <i>ln</i> (Publications) (Scopus)	(3) <i>ln</i> (Citations) (Google Scholar)	(4) <i>ln</i> (Citations) (Scopus)	(5) Citations per paper (Google Scholar)	(6) Citations per paper (Scopus)	(7) <i>h</i> -index (Google Scholar)
Facial attractiveness	0.0868 (0.798)	−0.0025 (−0.0243)	−0.0079 (−0.0532)	0.0612 (0.355)	−5.42 (−1.45)	−1.35 (−0.57)	−0.782 (−0.284)
Interactions							
Social science (business)*Beauty	0.0366 (0.248)	−7.3e−04 (−0.0055)	0.152 (0.715)	−0.018 (−0.0778)	3.55 (0.657)	2.65 (0.627)	0.767 (0.241)
Social science (others) *Beauty	−0.0146 (−0.0967)	−0.13 (−0.76)	0.0797 (0.356)	−0.0376 (−0.117)	6.76 (1.15)	3.9 (0.853)	3.07 (0.851)
Observations	354	328	351	297	360	297	351
R ²	0.324	0.444	0.389	0.347	0.165	0.091	0.269

The sample includes 368 academic speakers. Each column reports a separate ordinary least squares regression with controls for discipline (natural sciences and social sciences (business: e.g., economics, finance, management, and market; others: e.g., sociology, psychology, and politics)), gender, ethnicity (African and Asian vs. Caucasian), academic age (and its squared term), ranking of university bestowing highest degree, and dummies for Nobel Prize winner, North American based, and part-time academic. Full regression output is given in Supplementary Table S5. *t*-statistics are in parentheses. All coefficients reported are at $p > 0.10$.

Table 3 Facial attractiveness and external engagement: Impact of academic speakers.

		Facial attractiveness			B-H crit.	N	R ²
External impact		Coeff.	t-Stat.	p-Val.			
(1)	Number of books in Library of Congress	−0.402	(−0.661)	0.261	0.200	360	0.269
(3)	Nonfiction book award dummy	0.0026	(0.223)	0.872	0.167	360	0.082
(2)	NYT Best Seller (number of books)	0.0475	(1.34)	0.192	0.133	360	0.050
(4)	NYT Best Seller (number of weeks)	0.996 [†]	(1.75)	0.0879	0.100	360	0.034
(5)	Number of times invited to TED conference	0.057 [†]	(1.89)	0.0593	0.067	360	0.177
(6)	<i>ln</i> (Google Webpage)	0.207*	(2.15)	0.0459	0.033	307	0.077
Controlling for academic productivity							
(7)	Number of books on Library of Congress	−0.469	(−0.807)	0.278	0.167	351	0.493
(8)	Nonfiction book award dummy	0.0045	(0.381)	0.725	0.200	351	0.141
(9)	NYT Best Seller (number of books)	0.0463	(1.29)	0.202	0.133	351	0.087
(10)	NYT Best Seller (number of weeks)	1.03 [†]	(1.8)	0.0787	0.100	351	0.046
(11)	Number of times invited to TED conference	0.0561 [†]	(1.81)	0.0667	0.067	351	0.182
(12)	<i>ln</i> (Google Webpage)	0.156*	(1.99)	0.055	0.033	300	0.416

The sample includes 368 academic speakers. Each row reports a separate ordinary least squares regression with controls for discipline (natural sciences and social sciences), gender, ethnicity (African and Asian vs. Caucasian), academic age (and its squared term), ranking of university bestowing highest degree, and dummies for Nobel Prize winner, North American based, and part-time academic. Specifications (7) to (12) include the control variables number of publications and citations from Google Scholar. Full regression output is given in Supplementary Table S6. *t*-statistics are in parentheses. [†] $p < 0.10$; * $p < 0.05$. Based on Benjamini–Hochberg critical value (B-H crit.) for a false discovery rate of 0.2.

are active public speakers and thus judged by the public speaking portals as sufficiently attractive for a public speaking engagement, our identification of an unattractiveness premium for natural scientists is particularly interesting and the >20 percent effect for a one-unit increase in facial attractiveness (on a 10-point scale) is quite substantial. This result holds even for nonacademic speakers with a natural science background. Hence, although we do not explicitly explore stereotypes, our findings confirm the public and media stereotype of a “nerdy” or “geeky” natural scientist. Indeed, a Discover article referencing (Gheorghiu et al., 2017)’s research even notes an “ugly Einstein” effect that reflects a deeper phenomenon, a “cultural Cartesian dualism” implying that an individual can either be strong/have a beautiful body or have a brilliant mind, but not both⁵. Our analysis, however, demonstrates that the reverse is true for social scientists: not only are they less affected by the unattractiveness stereotype, they may actually benefit from a beauty premium.

Why then, do we observe such “beauty” and “ugly” premiums regarding speaking fees across fields? One plausible explanation could be that facial beauty is correlated with citation-based productivity. That is, although job performance in the academic environment (e.g., research output) is clearly identifiable and thus less subject to beauty-based discrimination, facial appearance may affect publication performance if reviewers or editors know the scholar or are able to match name and image online (Dilger et al., 2015). On the other hand, the very probability of publishing—and thus of being cited—may increase due to the tendency for attractive researchers to be accepted into better graduate schools, to have access to better PhD supervisors, to be hired into higher ranked and more prestigious universities, and to have a wider social and professional network (Fidrmuc and Paphawasit, 2018). Despite the correlational nature of our findings, such difference is less likely to be explained by speakers’ (perceived) quality as an academic, as demonstrated by the null relationship between facial attractiveness

Fig. 1 Effects of facial attractiveness on external influence measures between research fields. Coefficient estimates based on regression models with facial attractiveness*research field terms from Table 3. Markers (circle = models without controlling for academic productivity; diamonds = models controlling for academic productivity) represent the point estimate of the effect of facial attractiveness on each external influence measure for natural scientists (Nat. sci.*Beauty) and social scientists (Soc. sci. (business/others)*Beauty). Error bars represent 99.9%, 99%, 95%, and 90% confidence intervals. † $p < 0.10$; * $p < 0.05$.

and scholarly productivity or achievements in terms of publication and citation metrics among academic speakers. In other words, it is unlikely that less (more) attractive natural (social) scientists could capitalize on external prominence due to their academic success, while also controlling for scientist's societal reputation. Interestingly, we did not find that such stereotypical bias affects scientists' ability to generate social interest. Instead, our results indicate that facial attractiveness, regardless of their field of study, is positively correlated with measures of external influence where speakers' physical appearance is likely to be most apparent, for example, TED talk invitations or mentions on Google web page counts. In contrast, we did not find any significant effect of facial attractiveness on external engagement, such as publishing books or its recognition in terms of nonfiction book awards. This finding corresponds, to some extent, with previous literature in which the positive effect of physical attractiveness on the perception of teaching quality or effectiveness is found to be more salient in an environment with higher physical exposure or interaction (e.g., Hamermesh and Parker, 2005; Babin et al., 2019).

There are several limitations to this study. First, while prior research has found a weak, positive, but statistically significant relationship between the Anaface attractiveness scores and human attractiveness ratings (Babin et al., 2019), we were unable to provide our own validation due to research budget constraints. Follow-up studies should consider using an independent sample

to examine the robustness of the statistical relationship between human ratings and algorithm-based measures of facial attractiveness. In addition, the perception of facial attractiveness is likely to vary depending on the sample of evaluators employed. As such, one should carefully choose a sample of evaluators that represent the population of the target audience depending on the purpose of the study (e.g., high-school students, average citizens, or corporate audience). Despite the established correlations (see Supplementary Information) between the Anaface proxy and geometry-based attractiveness measures such as facial symmetry, neoclassical canons, and golden ratio, the cross-cultural validity of the latter two are problematic (Chen and Zhang, 2014; Heidekrueger et al., 2017) as they are Eurocentric constructions based on Greco-Roman and Western ideals (Bashour, 2006; Thomas and Dixon, 2016). Therefore, these measures are potentially less relevant for studies examining perceived facial attractiveness of non-Western cultures compared to facial averageness or symmetry that are biologically relevant measures of attractiveness. Such problematic proxies might be justifiable for the current context (which relied heavily on data from Western scholars), but future studies could explore the differences between those proxies by exploring a speaker pool from a non-Western culture. Lastly, there is a debate in the literature regarding the usefulness of simple citation-based metrics (such as total citation counts and h-index) as indicators of academic performance or research quality.

Fig. 2 Speaking fees charged and facial attractiveness, by field of study. Minimum speaking fee charged as a function of facial attractiveness of **a**, natural scientists, **b**, social scientists (business), and **c**, social scientists (others). Prediction based on regression results from specification 2 in Table 4. Shaded areas represent 90, 95, and 99% confidence interval for the predicted values.

Table 4 Facial attractiveness and public speaking fees.				
<i>ln</i> (minimum public speaking fees)	(1)	(2)	(3)	(4)
Facial attractiveness	−0.189* (−2.55)	−0.194* (−2.54)	−0.147† (−1.9)	−0.176** (−3.22)
Interactions				
Social science (business)*Beauty	0.204* (2.13)	0.189† (1.93)	0.189† (1.94)	0.201** (2.92)
Social science (others)*Beauty	0.364*** (3.55)	0.39*** (3.81)	0.262† (1.92)	0.329*** (3.98)
Sample	Academics	Academics	Nonacademics	All
Observations	307	300	257	564
R ²	0.226	0.240	0.305	0.260
Each column reports a separate ordinary least squares regression with controls for discipline (natural sciences and social sciences (business: e.g., economics, finance, management, and market; others: e.g., sociology, psychology, and politics)), gender, ethnicity (African and Asian vs. Caucasian), professional age (and its squared term), ranking of university bestowing highest degree, and dummies for Nobel Prize winner and North American based, and log of number of Google webpages. Levels of academic engagement (full-time vs. part-time) are controlled for in models (1), (2), and (4). Model (2) controls for academic productivity (number of publications and citations from Google Scholar). Full regression output is given in Supplementary Table S7. <i>t</i> -statistics are in parentheses. † <i>p</i> < 0.10; * <i>p</i> < 0.05; ** <i>p</i> < 0.01; *** <i>p</i> < 0.001.				

Due to the increasing pressure to perform, such measures are potentially subject to manipulations (e.g., see the excellent discussion in Fire and Guestrin, 2019). However, these measures may also capture public perception of academic quality or achievement. We have therefore demonstrated robustness of the null relationship between facial attractiveness and scholarly achievements by using metrics that are less prone to manipulation such as variants of the h-index, which accounts for the effect of co-authors, age of the publication, and citation patterns.

It would therefore be interesting to explore other possible channels through which facial attractiveness affects the ability to thrive in the speaking market, apart from a taste-based discrimination (stereotypes) explanation. For example, whether social and natural scientists also differ in characteristics such as sociability or social intelligence and how these traits are linked to attractiveness. It may also be worth investigating whether perceived dialectic differences in natural and social sciences (Lewontin and Levins, 1998) contribute to our understanding of beauty premium differences, particularly when oral

communication skills and confidence were shown as a contributor towards beauty premium in experimental labor market setting (Mobius and Rosenblat, 2006). Such insight is important given the often tenuous status of social sciences, and their perception as less solidly scientific than the natural sciences (Ecklund et al., 2018), which often forces social scientists to struggle for respect. This is despite the fact that social scientists are more actively engaged with the media, reflecting journalists’ and audiences’ selective interest in their type of research (Peters, 2013). Aspects such as perceived organizational, professional, or cultural conditions, and disciplinary socialization may also matter (Becher and Trowler, 2001), so investigating these could offer valuable insights into how appearances affect scientists’ perceived scientific communication skills, their public images, and/or the popularization of science in general.

In general, our results also add to the literature on the role played by facial attractiveness in scientific achievements by investigating the relationship using a sample of academics from different fields. Particularly, by examining a wide range of

scientific productivity metrics, we find no significant effect, which is consistent across academic fields. This null relationship between facial attractiveness and citation-based performance supports the findings of Dilger et al. (2015) using Business Research scientists but differs from Fidrmuc and Paphawasit (2018), where the authors found a substantial and significant positive effect among economic scholars. Nevertheless, this difference could stem from our sample selection of academics, who may have been more established at the time they chose to engage in public speaking actively. Therefore, further research using a representative sample of scientists across fields is required in order to reach a more conclusive relationship between physical attractiveness and scientific achievements between academic disciplines.

Data availability

The datasets generated and/or analyzed during this study are publicly available in the Open Science Framework (OSF) Data Repository <https://osf.io/n7upx/>.

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Notes

- 1 https://royalsocietypublishing.org/~/media/royal_society_content/policy/publications/2006/1111111395.pdf.
- 2 We use robust standard errors to obtain consistent (unbiased) OLS estimators under heteroscedasticity.
- 3 Squared term for professional age is included to control for potential non-linear relationship between age (experience) and the dependent variables.
- 4 With six dependent variables being tested, we admit that the findings could result from false positive discovery. Rather than relying on the more stringent and conservative corrections for family-wise error rate (FWER) (such as Bonferroni correction), we report the critical value based on the Benjamini-Hochberg procedure with false discovery rate of 0.2. Given the exploratory nature of this study, this approach controls for the false positive rate (FDR) without overly inflating the chance of false negatives due to loss of statistical power, which would render observed effect insignificant. The results based on the Benjamini-Hochberg procedure are congruent with that of conventional p-values.
- 5 <http://blogs.discovermagazine.com/neuroskeptic/2017/05/28/unattractive-better-scientists/#.Xmt22BHLvA1>.

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Author contributions

H.F.C. and B.T. designed research; W.B., C.H.F. collected data; W.B., H.F.C., and B.T. analyzed data; and W.B., H.F.C., and B.T. wrote the paper.

Competing interests

The authors declare no competing interests.

Additional information

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